

Imation

Invention Record

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Originating Imation Unit: Data Storage Systems	Send Original to I.P. Scientist/Manager: Robert W. Frits/CS/Imation
Title: Format Compatible Rapid Access Data Cartridge System with Extended Capacity	

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Include all of the following:**1. Short description of the invention:**

Rapid access and high data rate data cartridge systems compatible with existing automation and hosts can be achieved by replacing tape with disk drives or other forms of storage elements.

2. Describe the utility of the invention and describe the advantages of this invention over the current art.

The convergence of unit storage cost between rigid disks and tape systems makes this concept an economically viable disruptive technology. It also provides users of library systems a new dimension for near line applications. This invention can also compete directly with optical jukebox applications.

3. Provide one or more detailed examples which illustrate the invention. Incorporate any needed sketches or informal drawing in the text of the I.I.R.

The Invention

This invention describes a rapid access data cartridge and drive emulator which is compatible with existing tape drive formats, automation systems and host applications. This invention also provides a means to extend the format capacity and data transfer rate, without changes to the host application. The concept is illustrated in figure 1.

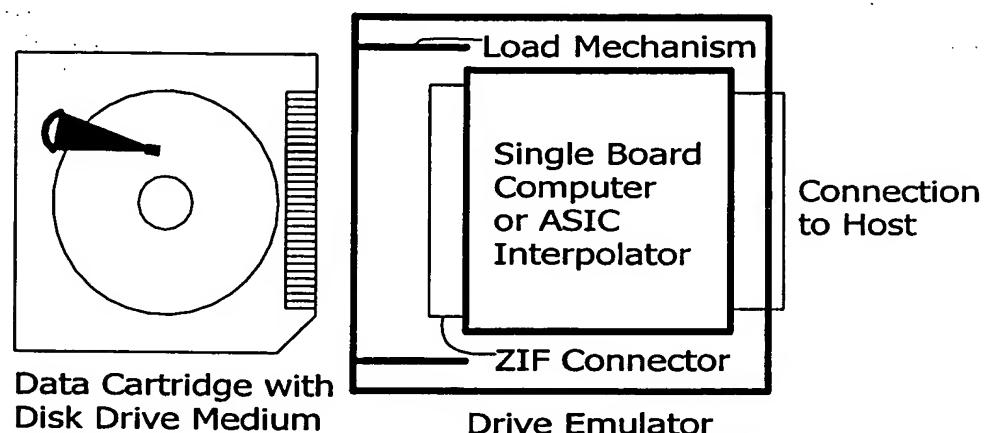


Figure 1

- ❖ The data storage element of an existing removable tape cartridge system is replaced with alternative medium such as a rigid disk drive.
 - The data cartridge physical dimensions and features are compatible with existing library automation.
 - Once the cartridge is loaded and powered up, time to data will be measured in milliseconds.
 - Current benchmark (8/2001) for single platter IDE disk drives is 40 GB, with a minimum of 20 MB/s sustained transfer rate, and approximately \$50 OEM pricing.

- ❖ The tape drive portion of the system would be replaced with an electronic interface, power supply, and receptacle mechanism for seating and electrically connecting to the cartridge. This device will herein be referred to as the "drive emulator".
 - The host application would see the drive emulator as a tape drive of the type that is being emulated.
 - Migration to larger capacity and higher data rates by upgrading the disk drive mechanism, and does not necessarily require a change in drive emulator hardware or host application drivers
 - Examples of systems where this can be implemented are 3590, 9840, 9940, SLR, DLT, and LTO.

- ❖ The data cartridge would contain at least the complete mechanical components of the disk drive, including motor, disk(s), and head actuator assembly. Analog electronics such as preamps and write drivers should also be contained within the cartridge.

- ❖ All of the disk drive electronics can be contained within the cartridge.

- The advantage of embedding all the disk drive electronics within the cartridge is the ability to use an industry standard interface (such as SCSI or IDE), without proprietary content.
 - This minimizes customization, and eases migration to larger capacity drives.
 - The disadvantage of embedding all the disk drive electronics into the cartridge is added weight, potentially higher cost, and lack of proprietary content.
- ❖ A portion of the disk drive electronics can reside on the drive emulator.
 - In high volume scenarios, this approach can reduce cost to the cartridge.
 - The disadvantage of this approach is a high degree of customization, restrictions on product migration, and limitations on disk drive suppliers.
- ❖ The drive emulator can contain some form of motorized Zero Insertion Force (ZIF) socket for making robust electrical connection to the cartridge I/O and power input.
 - ❖ The drive emulator receives commands and data from the host application, interprets it into the disk drive interface format, and vice versa. An example would be a SCSI host interface between host and emulator, and an EIDE interface between the emulator and cartridge disk drive.
 - The drive emulator function can be executed by a single board computer like a PC104, with the appropriate interface adapters (SCSI, EIDE, ESCON, FIBRE). This can be accomplished with commercially off-the-shelf components.
 - The same functionality with higher speed and lower cost can be achieved via custom ASIC.
 - ❖ Storage elements other than disk drives can also be used (ie. Flash memory).